

INCH-POUND

MIL-PRF-1/1773B  
26 February 1999  
SUPERSEDING  
MIL-PRF-1/1773A  
1 December 1997

## PERFORMANCE SPECIFICATION SHEET

### ELECTRON TUBE, MAGNETRON TYPE DOD-042

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

**DESCRIPTION:** Coaxial fixed frequency, 9,375 MHz  $\pm$  30 MHz, pulse type, 65-kw rated peak-power output, integral permanent magnet, air cooled.

#### ABSOLUTE RATINGS:

Parameter: Unit:	Ef V	If A	tk sec	tpc $\mu$ s	rrv kv/ $\mu$ s	Pi W	ib a	VSWR	Alt ft
Maximum	14	10 (surge)	----	5.5	187	240	19	1.5:1	10,000
Minimum	----	----	90	0.4	54	----	11	----	----

#### ABSOLUTE RATINGS:

Parameter: Unit:	Anode T $^{\circ}$ C	Cathode bushing T $^{\circ}$ C	Storage ambient T $^{\circ}$ C
Maximum	150	175	+85
Minimum	----	-55	-55
	(See note 17)	(See note 15)	

#### PHYSICAL CHARACTERISTICS:

Dimensions: Experience has shown that magnetron tubes conforming to outline drawing dimensions of figures 1, 1A, 2, 2A, 3, 3A, 4, and 4A satisfy form, fit and function interface requirements for installation within user APN-59 application systems. With qualifying activity approval alternative dimensions for selected non-interface critical requirements are permissible.

Weight: 6 pounds (approximate).

#### TEST CONDITIONS:

Parameter: Unit: Tolerance:	Ef V ---- 3/	tpc $\mu$ s $\pm$ 10%	Du ---- ----	rrv kv/ $\mu$ s $\pm$ 10%	lb mA dc ----
Test 1:	9.1	0.4	0.00065	170	9.8
Test 2:	9.1	0.4	0.00065	170	----
Test 3:	7.9	5.0	0.001	110	15
Test 4:	7.9	5.0	0.001	110	----
Test 5:	7.9	5.0	0.001	60	----

#### GENERAL:

Qualification - Required.

AMSC N/A

1 of 18

FSC 5960

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.



TABLE I. Testing and inspection.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Qualification inspection</u>								
Life test	----	<u>10/ 17/</u>	----	VSWR = 1.5:1 (min) with phase varying through a minimum of 0.5 $\lambda$ approximately every 15 minutes	----	2,000	----	Hours
Life-test end points:								
Power levels	4250	<u>1/</u>	3		Po	56	----	W
Frequency	----	----	3		F	9,345	9,405	MHz
Spectrum	4308	<u>4/ 5/ 12/</u>	3		BW	----	2.5/tpc	MHz
Spectrum	4308	<u>4/ 5/ 12/</u>	3		Ratio	8	----	dB
Pulse stability	4315	<u>12/</u> <u>12/</u>	1 3		MP MP	---- ----	2.0 2.0	% %
System compatibility life test	----	<u>6/ 18/</u> <u>19/</u>	----	Dummy load DA-146/U at R.F. waveguide output of R-T unit	----	800	----	Hours (run time)
End of life-test end-points: Vibration, mechanical	1032	<u>13/</u>	1	10 G; f = 50 Hz to 500 Hz; varied over complete range in not less than 5 minutes at uniform rate.	$\Delta F$	----	$\pm 0.5$	MHz
Direct-interelectrode capacitance	4266	----	----	Measured between cathode terminal and mounting plate.	Cin	9	14	pF
Barometric pressure, reduced	4028	<u>11/</u>	3	Pressure = 55 mm Hg absolute	----	----	----	----
<u>Conformance Inspection, part 1</u>								
Heater or filament current, nonoperating	4289	----	----	Ef = 12.6 V; tk = 180 seconds (min)	If	2.0	2.4	A
Pressurizing	4003	----	----	40 to 45 psia, input and output assemblies.	----	----	----	----
Power levels	4250	<u>1/</u> <u>1/</u>	1 3		Po Po	44 65	---- ----	W W
Spectrum	4308	<u>4/ 5/ 15/</u> <u>4/ 5/ 16/</u>	2 4		BW BW	---- ----	2.0/tpc 2.5/tpc	MHz MHz
Spectrum	4308	<u>4/ 5/ 15/</u> <u>4/ 5/ 16/</u>	2 4		Ratio Ratio	10 8	---- ----	dB dB
Pulse voltage	4306	----	3		epy	14.7	14.9	kv

See notes at end of table.



TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 1 - Continued</u>								
Pulse stability	4315	---- <u>9/</u>	1 3	Anode T at reference point = +100°C ±10°C  ib = 12 a to 15 a	MP MP	---- ----	0.25 0.25	% %
Frequency pulling figure	4310	----	1		ΔF	----	5	MHz
Frequency	----	17 on figures 1 thru 4A	3		F	9,345	9,405	MHz
Frequency pushing figure	4311	----	3		ΔF/Δib	----	0.1	MHz/a
<u>Conformance inspection, part 2</u>								
Vibration	----	<u>13/</u>	----	Ef = 12.6 V; 15 G; F = 60 Hz; duration 15 minutes; no heater cathode shorts during test	----	----	----	----
Shelf life	----	----	----	t = 90 days	----	----	----	----
Shelf life end points:								
Power output	----	----	3		Po	65	----	W
Stability	----	----	3		MP	----	0.25	%
Pulse stability	4315	----	3		MP	----	0.5	%
		----	5		MP	----	0.25	%
<u>Conformance inspection, part 3</u>								
Life test provisions								
Intermittent life	1501	<u>10/</u> <u>14/</u>	---- ----	Group D; VSWR = 1.5:1 (min) with phase varying through a minimum of 0.5 λ approximately every 15 minutes	----	2,000	----	Cycles
Life-test end points:								
Power levels	4250	<u>1/</u>	3		Po	56	----	W
Frequency	----	----	3		F	9,345	9,405	MHz
Spectrum	4308	<u>4/ 5/ 12/</u>	3		BW	----	2.5/tpc	MHz
Spectrum	4308	<u>4/ 5/ 12/</u>	3		Ratio	8.0	----	dB
Pulse stability	4315	<u>12/</u>	1		MP	----	2.0	%
		<u>12/</u>	3		MP	----	2.0	%

See notes at end of table



TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Test	Conditions	Symbol	Limits		Unit
						Min	Max	
<u>Conformance inspection, part 3 -Continued</u>								
System compatibility life test	----	<u>6/ 18/ 19/</u>	----	Dummy load DA-146/U at R.F. waveguide output of R-T unit	----	800	----	Hours (run time)
End of life-test end points periodic tests								
Shock, specified pulse	1042	<u>2/</u>	2	50 G; 4 ms duration, no voltages	----	----	----	----
Magnetron nonoscillating impedance (phase of sink)	4309	<u>7/</u>	----		Distance	0.26	0.4	$\lambda_g$
Temperature coefficient	4027	17 on figures 1 thru 4A	1	Anode = +70°C to +100°C at reference point	$\Delta F/^{\circ}C$	----	0.25	MHz/ $^{\circ}C$
High-and-low-temperature performance (operating)	1047	----	1	tk = 90 s max; T = -55°C	MP	----	1.0	%
Forced convection	1143	<u>8/</u>	1		$\Delta T$	----	50	$^{\circ}C$

1/ The tube heater shall be protected against arcing by the use of a capacitor that places a minimum capacitance of 4,000 pF across the heater directly at the input terminals.

2/ The magnetron shall be capable of specified performance when subjected to a 50 G, 4 ms duration, half sine shock pulse in accordance with MIL-STD-202, method 213B.

The mounting plate of the magnetron shall be bolted to a test fixture that is bolted directly to the table of the shock test machine.

The magnetron shall be given one shock pulse in each of the following directions:

- Parallel to cathode, with cathode terminals pointing away from the impact surface.
- Perpendicular to cathode axis and output waveguide axis.
- Perpendicular to cathode axis and parallel to the output waveguide axis.

Post shock test results shall show no mechanical failure and the magnetron shall meet the electrical requirements of conformance inspection, part 1.

3/ A tk of 180 seconds (minimum) with an Ef of 12.6 volts is required before test.

4/ The tube shall be operated into a transmission line with a VSWR of 1.5:1 adjusted in phase to produce maximum spectrum degradation.

5/ A suitable spectrum shall be considered one in which the major lobe has a shape such that its slope does not change sign more than once for power levels greater than the specified dB below its peak.



TABLE I. Testing and inspection - Continued.

- 6/ System compatibility life test shall be conducted with the magnetron mounted in the AN/APN-59 R-T unit and shall follow the AN/APN-59 R-T unit checkout procedure in accordance with T.O. 12P5-2APN59-63. One tube per contract quantity shall be system compatibility life tested prior to delivery of the production quantity. For long term contracts, one tube per year shall be subjected to system compatibility life testing. System compatibility life test TUT shall be a different sample from the life test TUT. Following the 800 hour system compatibility life test, the TUT shall meet life-test end points.
- 7/ Using a standard cold-test technique, the phase of sink as measured from the output flange to the first minimum, toward the load, shall be within the limits specified.
- 8/ An airflow of 15 cfm at approximately 760 mm Hg shall be directed on the cooling fins from an orifice of 2.5 inches (63.5 mm) x 1.188 inches (30.18 mm). The temperature rise shall be measured at that point on the anode block as shown on figure 1 (see figures 1 through 4A, note 17).
- 9/ This test shall be the first one performed after the specified holding period.
- 10/ Air cooling shall be adjusted so that the anode block runs at +150°C, or at the maximum temperature it will reach in the absence of cooling, whichever is lower. This shall be adjusted during the test condition 3 portions of the qualification inspection and the intermittent life test cycles.
- 11/ The tube shall be operated in a transmission line with a load VSWR of 1.5:1 and a variable phase. At specified pressure, there shall be no evidence of breakdown at the input or output assemblies.
- 12/ If during life test the tube does not meet the specified limits, it shall be recycled for an additional five cycles. At such time, the test shall be repeated. Should the tube fail the second test, it shall be considered unsatisfactory.
- 13/ Direction of vibration shall be in a plane perpendicular to the axis of the cathode.
- 14/ Intermittent life test shall be conducted in accordance with the following cycle:

Condition	Ib	Ef	Duration
Standby	----	12.6 V	3 minutes
Test 1	9.8 mA	9.1 V	3 minutes
Test 3	15.0 mA	7.9 V	15 minutes
Off	----	0	9 minutes (minimum)

- 15/ Measurements shall be made at 11 a and 19 a.
- 16/ Measurements shall be made at 12 a and 19 a.
- 17/ Qualification inspection life test shall be conducted with the following cycle:

Condition	Ib	Ef	Duration
Standby	----	12.6 V	3 minutes
Test 1	9.8 mA	9.1 V	15 minutes
Test 3	15.0 mA	7.9 V	30 minutes
Off	----	0	12 minutes



TABLE I. Testing and inspection - Continued.

18/ System compatibility life test shall be conducted with the following cycle:

Condition	$t_{pc}$	$P_{rr}$	$D_u$	Duration
Standby (delay time)	---	---	---	3 minutes
100 mile range	4.5 $\mu$ s	180 pps	0.00081	8 hours
50 mile range	0.8 $\mu$ s	1025 pps	0.00082	2 hours
100 mile range	4.5 $\mu$ s	180 pps	0.00081	5 ½ hours
Off	---	---	---	30 minutes

System compatibility life test shall be run continuously, without delays, until a total of 800 hours "on time" is accumulated (at the rate of 15 ½ hours "on time" per test cycle). The manufacturer shall submit to the qualifying activity for evaluation all life test data and system compatibility life test result data and supporting documentation to demonstrate compliance with test requirements, prior to qualification listing or maintaining qualification listing.

19/ Air cooling shall be adjusted so that the anode block runs at +150°C, or at the maximum temperature it will reach in the absence of cooling, whichever is lower. This shall be adjusted during the 8 hour duration test condition (100 mile transmit range) portion of the system compatibility life test cycle (see 18/).



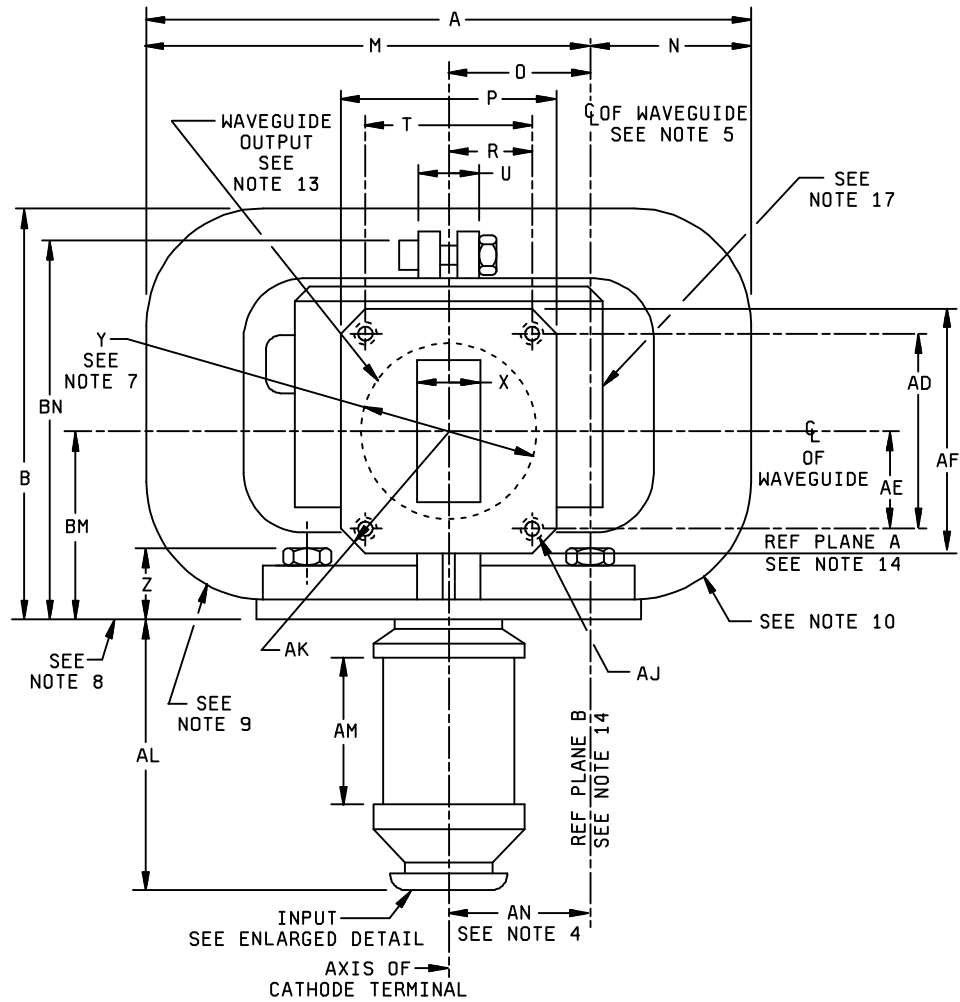


FIGURE 1. Outline drawing of electron tube type DOD-042 (front view).



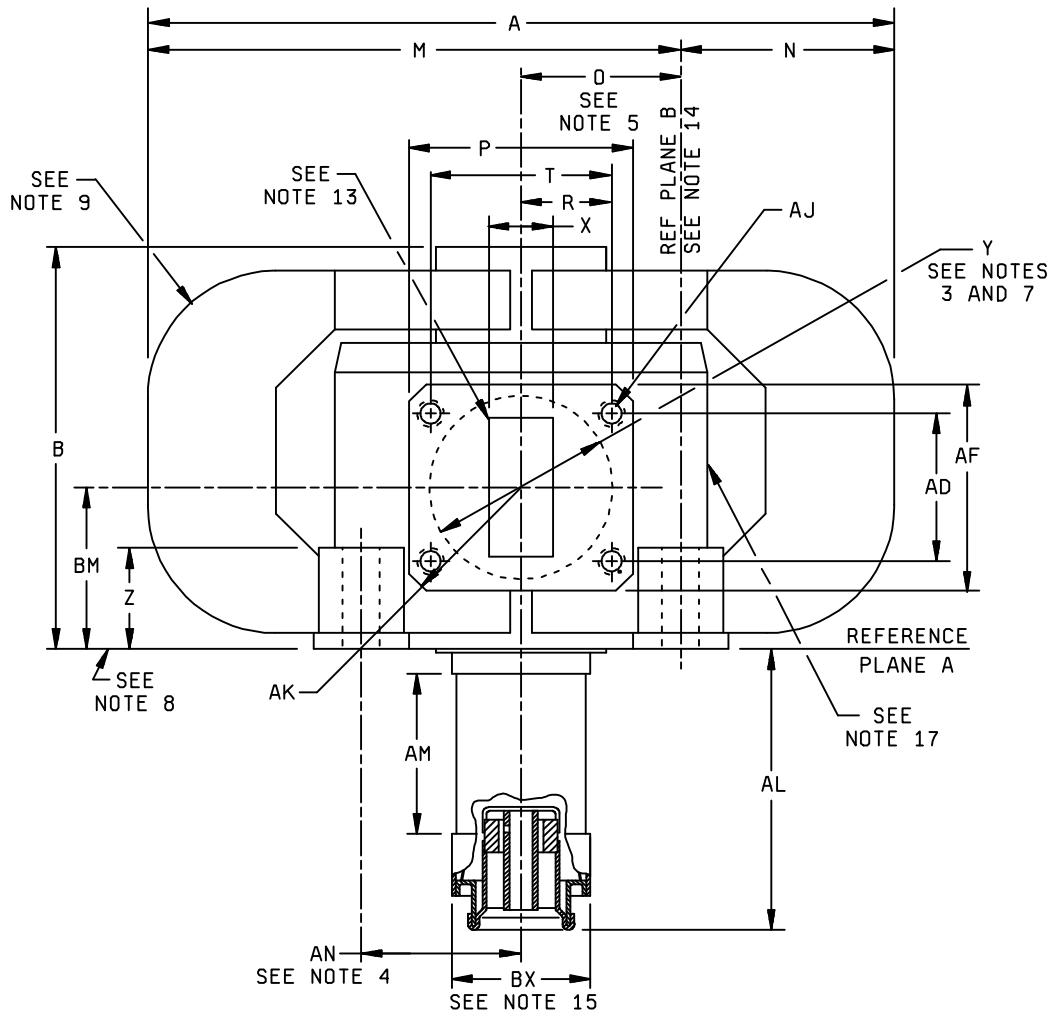


FIGURE 1A. Alternate outline drawing of electron tube type DOD-042 (front view).



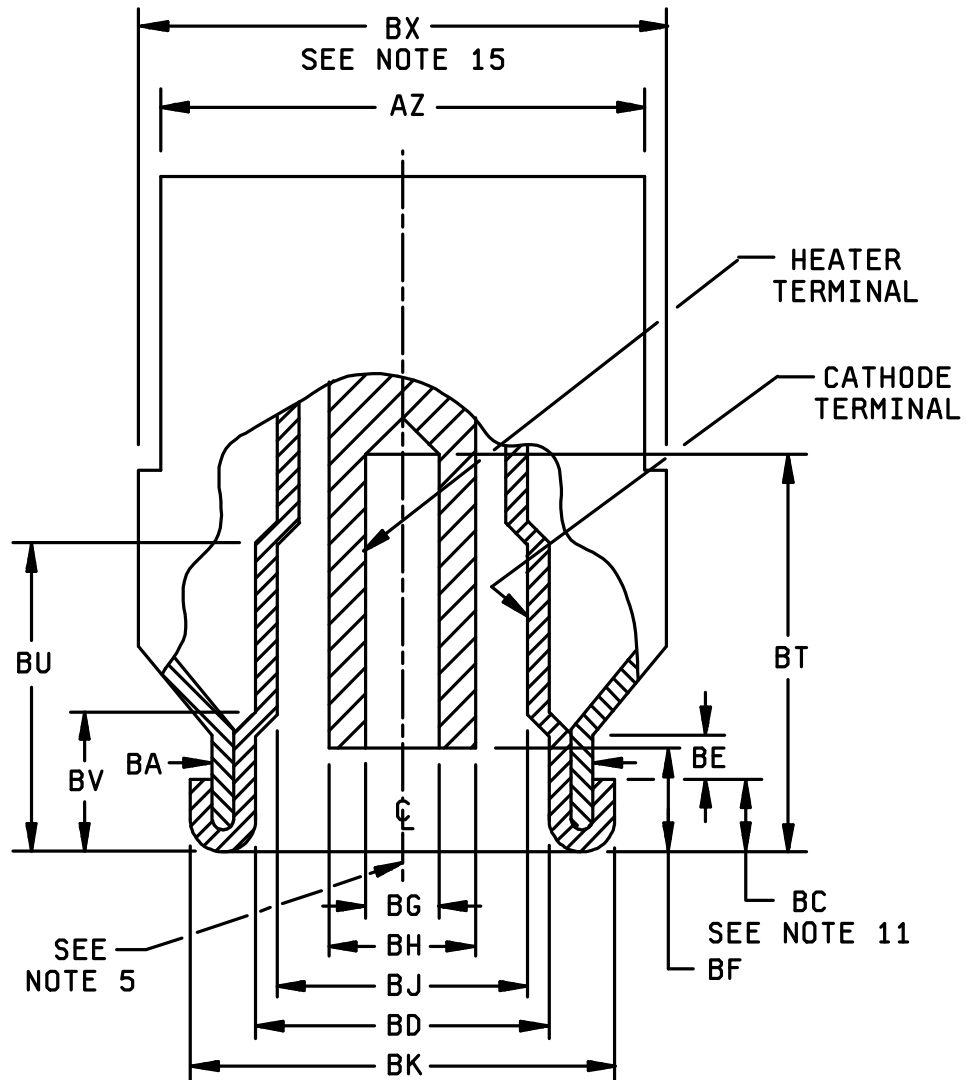


FIGURE 2. Outline drawing of electron tube type DOD-042 (detail enlarged).



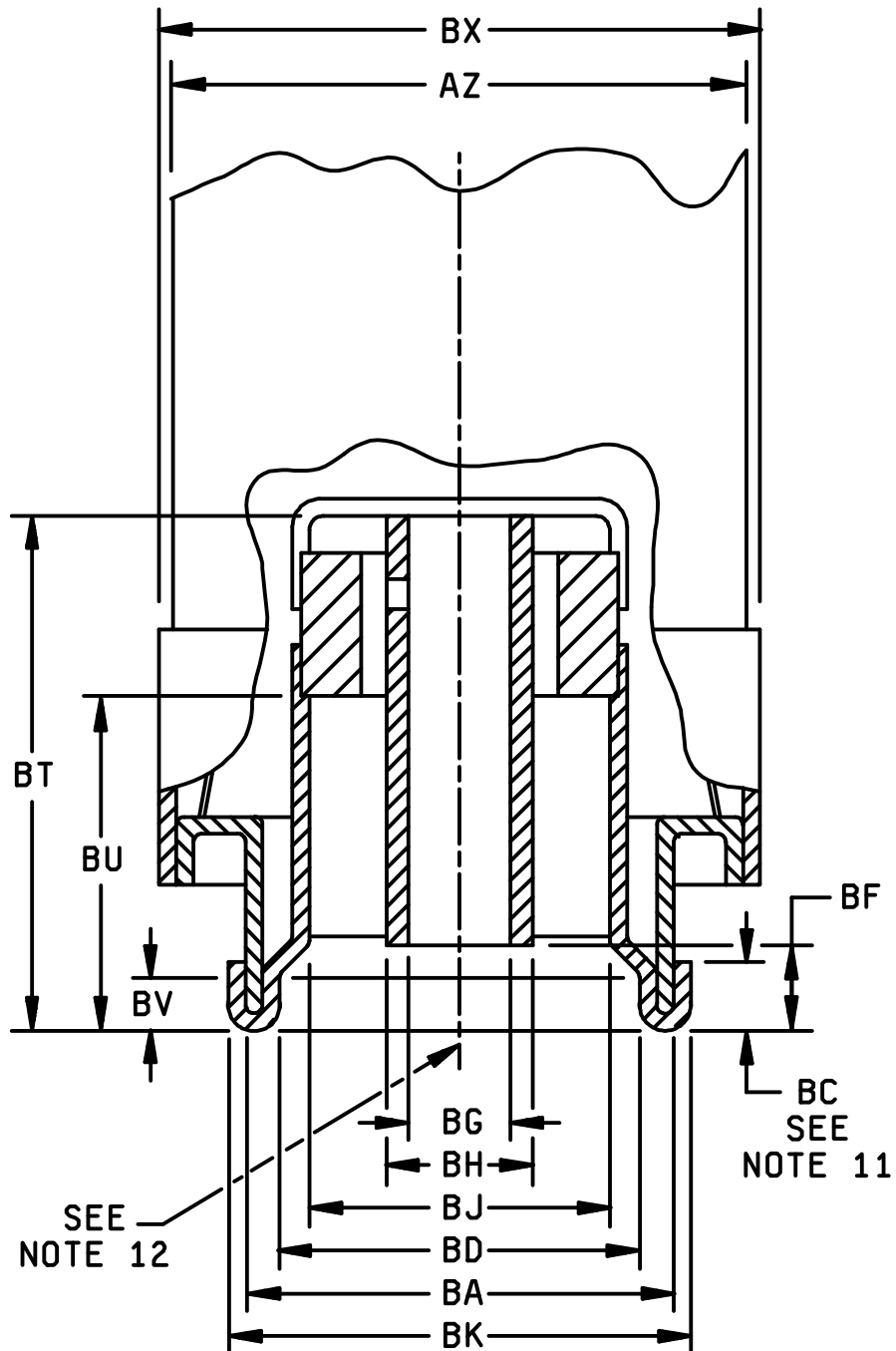


FIGURE 2A. Alternate outline drawing of electron tube type DOD-042 (detail enlarged).



## MIL-PRF-1/1773B

Figure	Ltr	Dimensions				Notes
		Inches		Millimeters		
Conformance inspection, part 1						
		Min	Max	Min	Max	
1, 1A	O	1.250	1.280	31.75	32.51	5
1, 1A	R	.732	.742	18.59	18.85	
1, 1A	T	1.470	1.478	37.34	37.54	
1, 1A	Z	.594	.656	15.09	16.66	
1, 1A	AD	1.348	1.356	32.24	34.44	
1	AE	.671	.681	17.04	17.30	
1, 1A	AL	2.094	2.219	53.19	56.36	
2, 2A	BC	.115	.135	2.92	3.43	11
2, 2A	BD	.610	.650	15.49	16.51	
2, 2A	BF	.125	.187	3.18	4.75	
2, 2A	BG	.164	.174	4.17	4.42	
2, 2A	BH	.234	.266	5.94	6.76	
2, 2A	BJ	.532	.545	13.51	13.84	
2, 2A	BK	.825	.838	20.96	21.29	
1, 1A	BM	1.386	1.426	35.20	36.22	
Conformance inspection, part 2						
1, 1A	A	----	5.938	----	150.83	
1, 1A	B	----	3.156	----	80.16	
1, 1A	M	---	4.250	----	107.95	
1, 1A	N	----	1.688	----	42.88	
1	U	----	1.438	----	36.53	
1, 1A	AM	1.250	----	31.75	----	
2	BE	.125	----	3.18	----	
1	BN	----	2.938	----	74.63	
2, 2A	BT	.750	----	19.05	----	
2, 2A	BU	.516	----	13.11	----	
2, 2A	BV	----	.200	----	5.08	
Conformance inspection, part 3						1
1, 1A	P	----	1.830	----	46.48	
1, 1A	AF	----	1.830	----	46.48	
Reference dimensions						
1, 1A	X	0.497		12.62		
1	Y	1.625		41.28		
1A		1.516		38.51		
1, 1A	AJ	.164-32 UNC-2B				
1, 1A	AK	1.156		29.36		
1, 1A	AN	1.265		32.13		4
2	AZ	1.125		28.58		
2A		1.100		27.94		
2	BA	0.750		19.05		
2A		0.772		19.61		
2	BX	1.000		25.40		15
2A		1.125		28.57		

FIGURES 1, 1A, 2, and 2A. Outline drawing of electron tube type DOD-042.



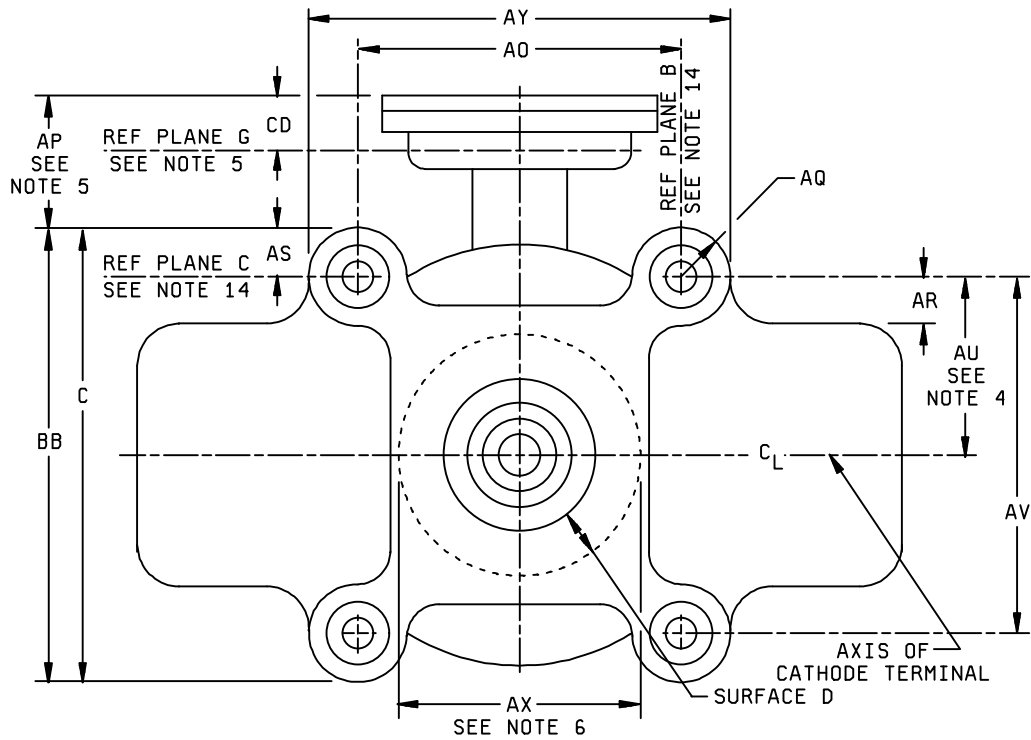


FIGURE 3. Outline drawing of electron tube type DOD-042 (bottom view).



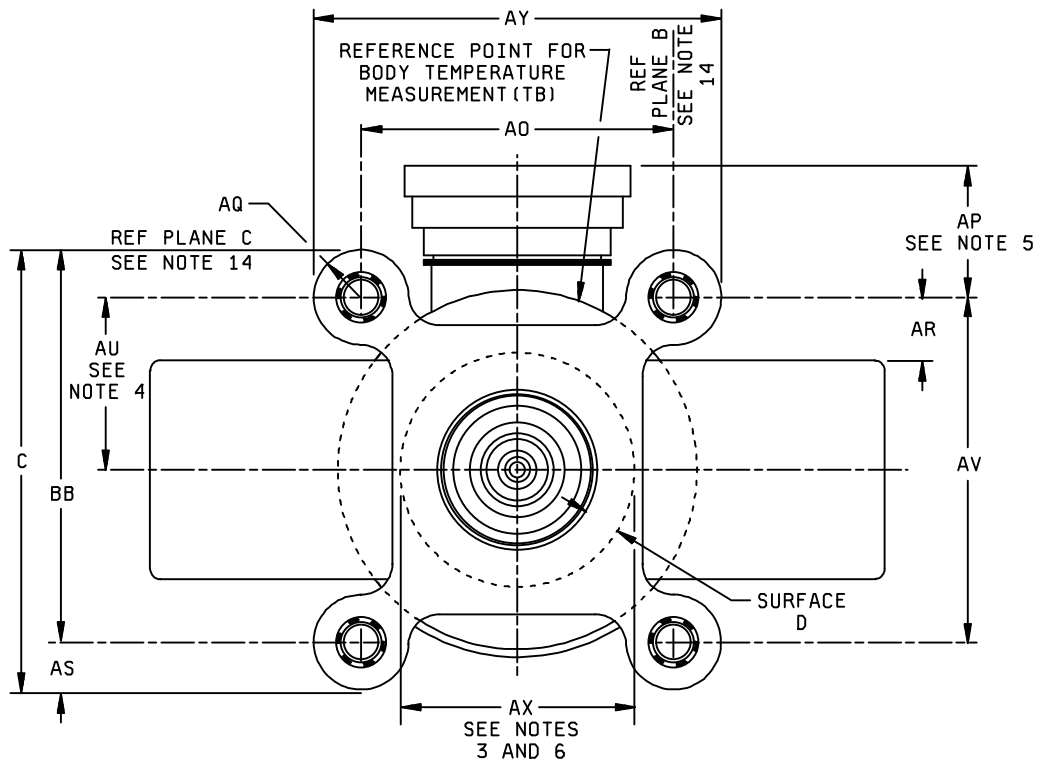


FIGURE 3A. Alternate outline drawing of electron tube type DOD-042 (bottom view).



Figure	Ltr	Dimensions				Notes
		Inches		Millimeters		
Conformance inspection, part 1						
		Min	Max	Min	Max	
3, 3A	AP	.990	1.040	25.15	26.42	5
3, 3A	AV	2.771	2.791	70.38	70.89	
3, 3A	AO	2.521	2.541	64.03	64.54	
Conformance inspection, part 2						
3, 3A	C	----	3.625	----	92.08	
3, 3A	AR	----	.594	----	15.09	
3, 3A	AS	----	.422	----	10.72	
3, 3A	AX	1.875	----	47.62	----	6
3, 3A	AY	----	3.483	----	87.33	
3, 3A	BB	----	3.203	----	81.36	
Conformance inspection, part 3 periodic check						1
Reference dimensions						
3, 3A	AQ	.375		9.52		
3, 3A	AU	1.391		35.33		4
3	CD	.411		10.44		5

FIGURES 3 and 3A. Outline drawing of electron tube type DOD-042 (bottom view).



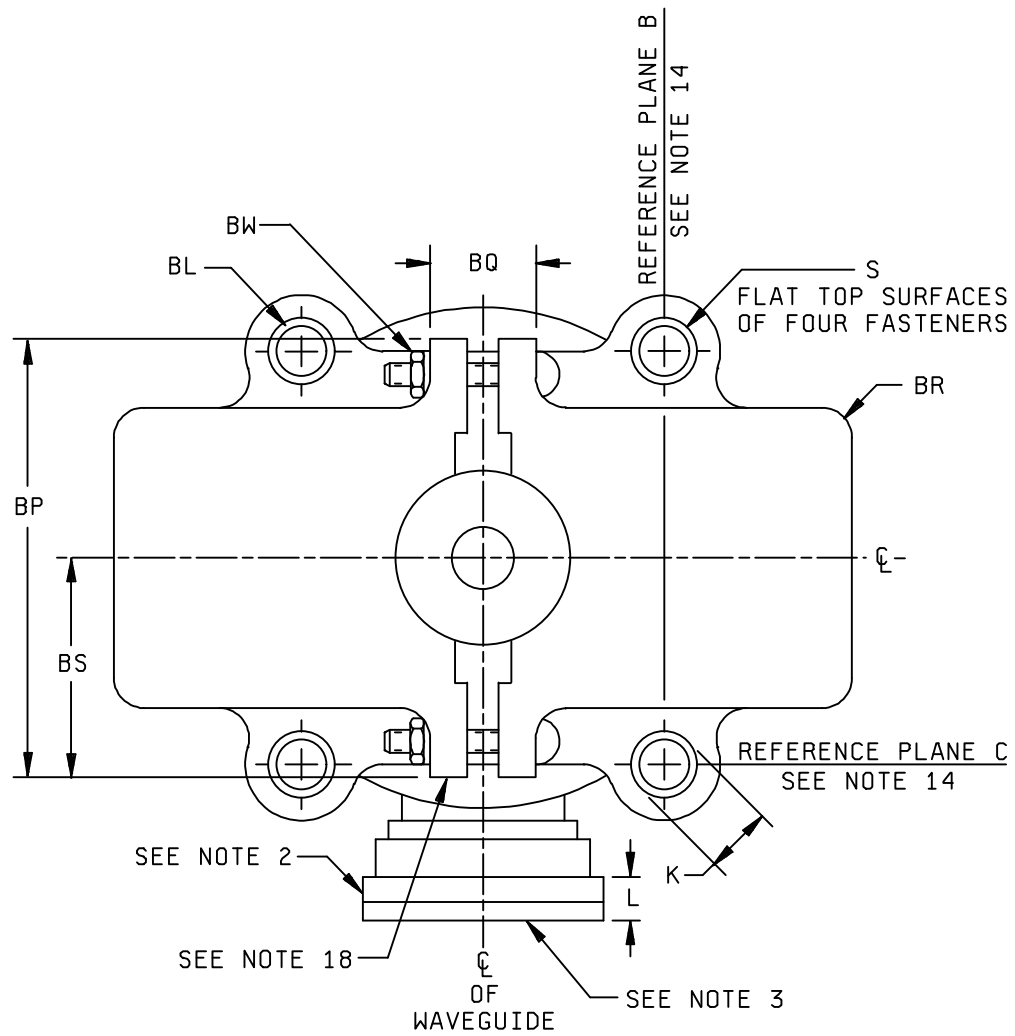


FIGURE 4. Outline drawing of electron tube type DOD-042 (top view).



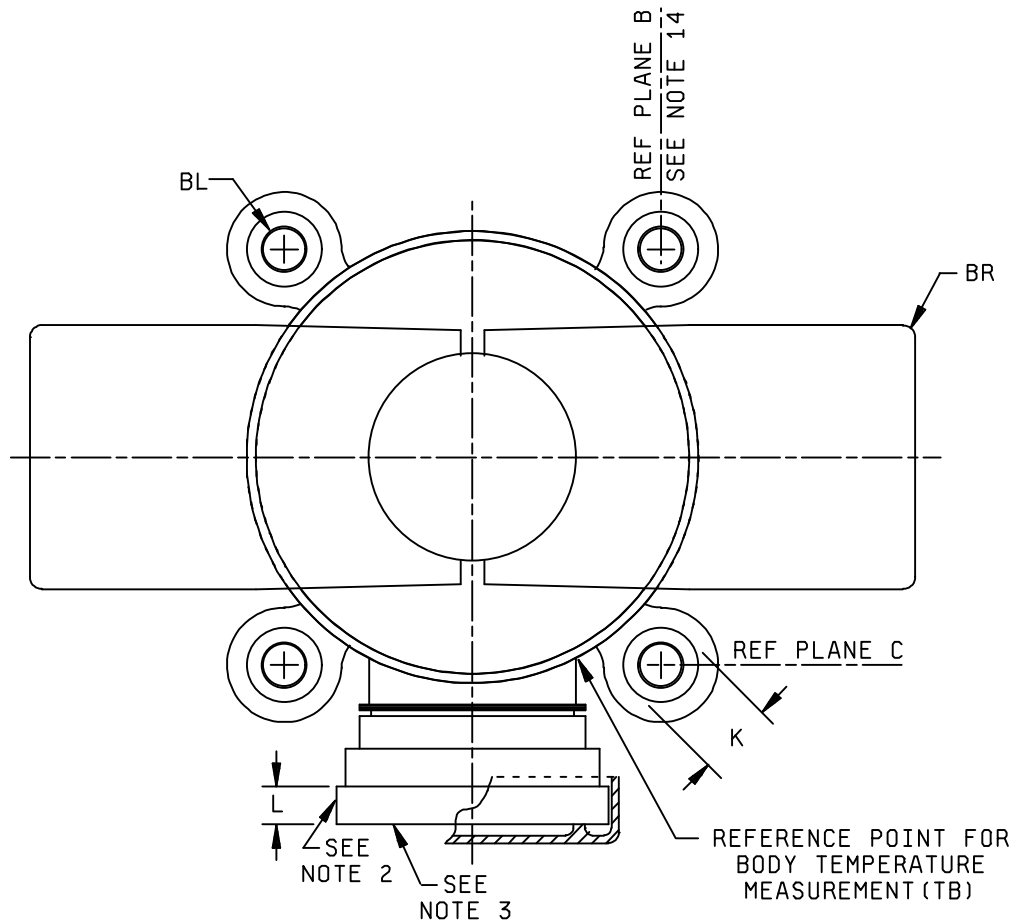


FIGURE 4A. Alternate outline drawing of electron tube type DOD-042 (top view).



## MIL-PRF-1/1773B

Figure	Ltr	Dimensions				Notes
		Inches		Millimeters		
Conformance inspection, part 1						
		Min	Max	Min	Max	
4	BS	1.334	1.438	33.88	36.53	
4, 4A	BL	.276	.286	7.01	7.26	
Conformance inspection, part 3						
4	BP	----	2.875	----	73.02	
4	BQ	----	.625	----	15.88	
4, 4A	BR	.031R	----	0.79	----	
Conformance inspection, part 2						
Reference dimensions						
Nominal						
4, 4A	K	.500		12.70		
4, 4A	L	.250		6.35		
4	BW	.138-32 UNC-2A				

## NOTES:

1. If these tests have been previously performed by the tube manufacturer, and if the material, manufacturing process, and test requirements are the same as when the tests were performed, the subject test(s) need not be performed.
2. All metal surfaces shall be corrosion resistant for the lifetime of the magnetron. Surface finishes may be used on metals except on surfaces designated S and D. Surface finishes shall prevent galvanic corrosion and prevent electrical contact (directly or through moist conductive media) between dissimilar metals. Surface finishes shall themselves meet and enable the magnetron to meet all interface and performance requirements. Surface S shall consist of or be plated with material providing electrical conductivity and corrosion resistance equivalent to that of gold, silver, nickel or bright alloy plating. If nickel plating is required, it is recommended that it be used only when other platings cannot meet performance requirements. Surface S plating shall meet and enable the magnetron to meet all interface and performance requirements.
3. Hermetic connections may be made to surface D.
4. Axis of cathode terminal shall occupy specified location within .047 inch (1.19 mm) radius. Note 7 shall apply.
5. Limits include angular and lateral deviations.
6. Diameter AX shall meet interface requirements for flatness and parallelism to reference plane A within .010 inch (0.25 mm) over the extent of AX. Surface flatness and parallelism shall enable the interface to meet hermetic seal requirements and enable the magnetron to meet all performance requirements.
7. Diameter Y shall meet interface requirements for flatness of .005 inch (0.13 mm) over the extent of Y. Surface flatness shall enable the interface to meet hermetic seal requirements and enable the magnetron to meet all performance requirements.
8. To satisfy system interface mating requirements, any portion of the magnetron assembly which extends below reference plane A shall be within .625 inch (15.88 mm) radius of the specified axis of input. Input concentricity is an essential interface requirement.
9. See note 10. Warning: In handling and mounting the magnetron care shall be exercised to prevent demagnetization. Neither ferromagnetic materials nor energized magnets shall be brought within two inches of the magnetron or its magnet.
10. Manufacturers code designation and tube serial number shall appear within this area.
11. Clamping shall be confined to this area.
12. Heater terminal and cathode terminal shall be concentric within .010 inch (0.25 mm).
13. Protective covers shall be provided with tubes.
14. Reference planes A, B, and C are mutually perpendicular.
15. Reference point for cathode temperature measurements. Located on the diameter, dimension BX.
16. Materials or their surface plating shall satisfy thermal coefficient of expansion compatibility requirements with ceramic materials they contact and shall be corrosion resistant for the life of the magnetron. Surface plating shall provide electrical conductivity and corrosion resistance equivalent to gold, silver or nickel plate over the full extent of input connector penetration. If nickel plating is required, it is recommended that it be used only when other platings cannot meet performance requirements. Surface plating shall meet and enable the magnetron to meet all interface and performance requirements.
17. Reference point for anode temperature measurements. Located on body near output section.
18. Magnet lugs, when included, shall satisfy interface mating requirements such that extremity of magnet lugs shall coincide with reference plane C within .094 inch (2.39 mm).
19. For vibration tests, planes of vibration shall be reference planes A, B, and C.

FIGURES 1 THROUGH 4A. Outline drawing of electron tube type DOD-042.



MIL-PRF-1/1773B

Custodians:

Army - CR  
Navy - EC  
Air Force - 11

Preparing activity:

DLA - CC

(Project 5960-3540)

Review activities:

Army - CR4  
Navy - AS, CG, OS, SH  
Air Force - 84, 99